SATrends ICRISAT's monthly e-newsletter

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1. At the root of the solution!

In SATrends issue 62 (January 2006), we reported that *DREB1A* transcription factor from *Arabidopsis thaliana*, when introduced transgenically into groundnut and expressed under the control of a stress-responsive promoter from A. *thaliana rd29A gene*, appears to confer water-economizing capacity compared to its wild type parent variety JL 24 (WT). We now have some exciting observations on roots of *DREB1A* transgenics.

Using a lysimetric system, these transgenic groundnuts were grown in 1.2 m long and 16 cm diameter PVC tubes, closely mimicking field conditions. Five transgenic events were assessed along with their WT by growing them for 30 days. At 30 DAS, following cylinder saturation with water, 6 plants were maintained under well-watered conditions (WW) by compensating their water loss, while the other 6 were water stressed (WS). The weight of cylinders was recorded every 3 days to measure the plant water uptake. The total plant water uptake under WS was higher in the transgenics than in the WT, whereas under WW the total plant water uptake was similar in all genotypes.

Remarkably, the root dry weight of all genotypes was very similar under WW conditions (1.48 - 1.63 g. WT was 1.61 g). By contrast, the root dry weight of WT remained unchanged under WS (1.73g), whereas that of all the transgenics dramatically increased (2.27 - 2.65 g range) by 30% overall (Figure 1A). Under WW, the root/shoot ratio was similar and slightly larger in WT than in the transgenics. By contrast, under WS the root/shoot ratio dramatically increased in all transgenics and became higher than in WT (Figure 1B).

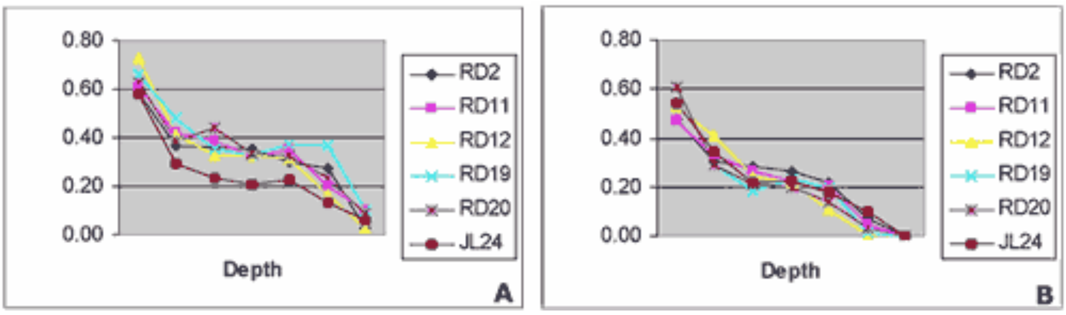

Figure 1A,B: Distribution of root dry weight over different depth in 5 transgenic DREB1A::rd29 events and wild type JL 24, at 35 days after imposing water stress (A) and under well-watered conditions (B).

Although, under WW conditions, no rooting differences were observed between the genotypes (Figure 2), under WS all the tested transgenics had more profuse deep rooting than the WT. In fact, there was an excellent relation between the root dry weight within the 40 -120 cm depth and the total plant water uptake (r^2 = 0.91). As a consequence, shoot dry weight was 20 - 40% higher than WT under WS only. Moreover, the transpiration efficiency (TE) under WS was found to be 20% higher in events RD2, RD11, and RD20 than in WT.

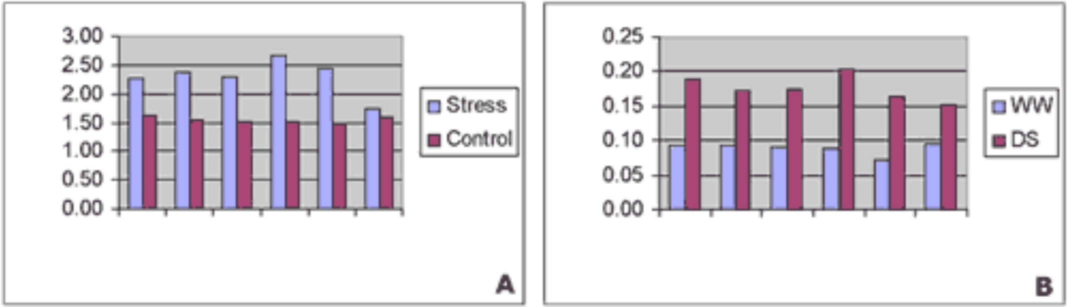

Figure 2A,B: Root DW (A) and root/shoot ratio (B) in 5 transgenic DREB1A::rd29 events and wild type JL 24, at 35 days after imposing water stress and under well-watered conditions.

Hence, it appears that *DREB1A* clearly induced a positive root response under water deficit conditions. Now we hope to look at a holistic approach to compare how this transcription factor might regulate the water relations in transgenic plants under natural water-limiting conditions.

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